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# CLINKER-PROOF LONG LIFE FURNACE WALLS



BERNITZ-FURNACE-APPLIANCE-COMPANY

1995 APRIL COMM

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# BERNITZ FURNACE APPLIANCE CO.

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#### B R A N C H   O F F I C E S

Atlanta  
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*1924 Edition*

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## CLINKER-PROOF FURNACE WALLS

The BERNITZ METHOD is a construction applied to furnace walls for the purpose of increasing their life; for eliminating clinker adhesion and associated troubles; and for assuring high furnace efficiencies and more continuous operation.

### THE BERNITZ METHOD OF CLINKER-PROOF FURNACE WALL CONSTRUCTION

(Pat'd Oct. 11, 1921) consists of ventilated furnace walls at the fuel zone. Perforated blocks, made of high grade refractory material, take the place of the usual 9" inner lining of fire brick which contacts with the fuel bed. A 2" air chamber is obtained directly in the rear of these blocks, as the blocks are 7" deep. Air, under the same pressure as used in the tuyeres or grates, is supplied to this chamber from which it is discharged thru apertures in the blocks, thence percolating directly into the fuel bed.

In the case of forced draft stoker installations, the air supply is obtained direct from stoker wind box; the main stoker damper therefore controlling the Bernitz air supply automatically in direct proportion as it is supplied to tuyeres.

In natural draft installations the furnace draft induces air thru blocks either from port holes to the outside atmosphere or from the ash pit.

Perforations in the Bernitz Blocks are in the form of conical apertures flaring outwardly toward the fire, i.e., the small end of aperture is on the rear face of the block and the large hole on the fire face. This shape of aperture has several decided advantages. The velocity of air is decreased as it passes thru the block, thereby expanding it within the block and giving maximum cooling effect on the linings. In addition, this expansion of air holds the air to the fire face of the lining. This expansion of air within the block and curtain of air flushing the fire face make the linings heat-resistant and consequently *clinker-proof*, as the temperature of the lining is kept well below the softening point where molten clinkers adhere. Further, the admission of air into the fuel bed here keeps slag and clinkers in a porous condition.

The small openings on the rear face naturally control the supply of air thru the block. Bernitz Blocks regulate this supply uniformly and permanently, as this control hole is away from the extreme heat of the fire and removed from contact with cleaning tools.

Bernitz Blocks with ample large openings on the fire face offer the least possible unprotected surface and slag does not readily arch over the large opening.

The heat taken out of the linings by the Bernitz System, is delivered back into the furnace as pre-heated air.

## ADAPTABILITY

BERNITZ CLINKER-PROOF BLOCKS are in extensive use at leading central station and industrial power plants.

They are readily installed in existing as well as new boiler furnaces and should be in use wherever the formation of clinkers on furnace linings or the rapid deterioration of settings interferes with efficient and continuous operation.

They are of special value in furnaces equipped with underfeet stokers and forced draft where high ratings are obtained and in which the settings deteriorate rapidly from intensive heat and removal of troublesome clinkers.

Bernitz Blocks are needed protection in oil burning furnaces where the blow torch action of flames burns out the brickwork. Without any reduction in boiler efficiencies, Bernitz Blocks in oil burning furnaces are successfully making a marked reduction in brickwork repairs, and therefore greatly increasing the life of the entire setting.

The Bernitz Construction is also adapted to producers for gas, etc. (Ask for our special bulletin).

In addition to the standard shapes, which are carried in stock, we design and make special shapes for various conditions.

THE BERNITZ CONSTRUCTION ASSURES FREEDOM FROM ADHERING CLINKERS, MINIMUM SETTING MAINTENANCE, CONTINUOUS AND EFFICIENT OPERATION OF BOILER FURNACES, AND ELIMINATION OF MUCH ARDUOUS LABOR.

## ADVANTAGES IN USING THE BERNITZ CONSTRUCTION

1. Allows high furnace temperatures or over-rating; of boilers, because the linings in contact with the fuel bed are free from clinker adhesion and troubles, and the linings will not over-heat

2. Increases furnace capacities, because the absence of projecting clinkers gives a full active grate surface at all times.

3. Aids combustion and conserves fuel.

The process of burning down, cleaning, and rebuilding fires at cleaning periods is done away with.

The time in cleaning walls and dumping fires is shortened, thereby greatly reducing the influx of cold air thru the fire doors.

Coke is burned off the grates before dumping.

Combustion along the side walls is more complete and regulation more even.

4. Greatly increases life of furnace walls and settings. Life of walls in contact with fuel bed averages four to six times that obtained with solid linings.

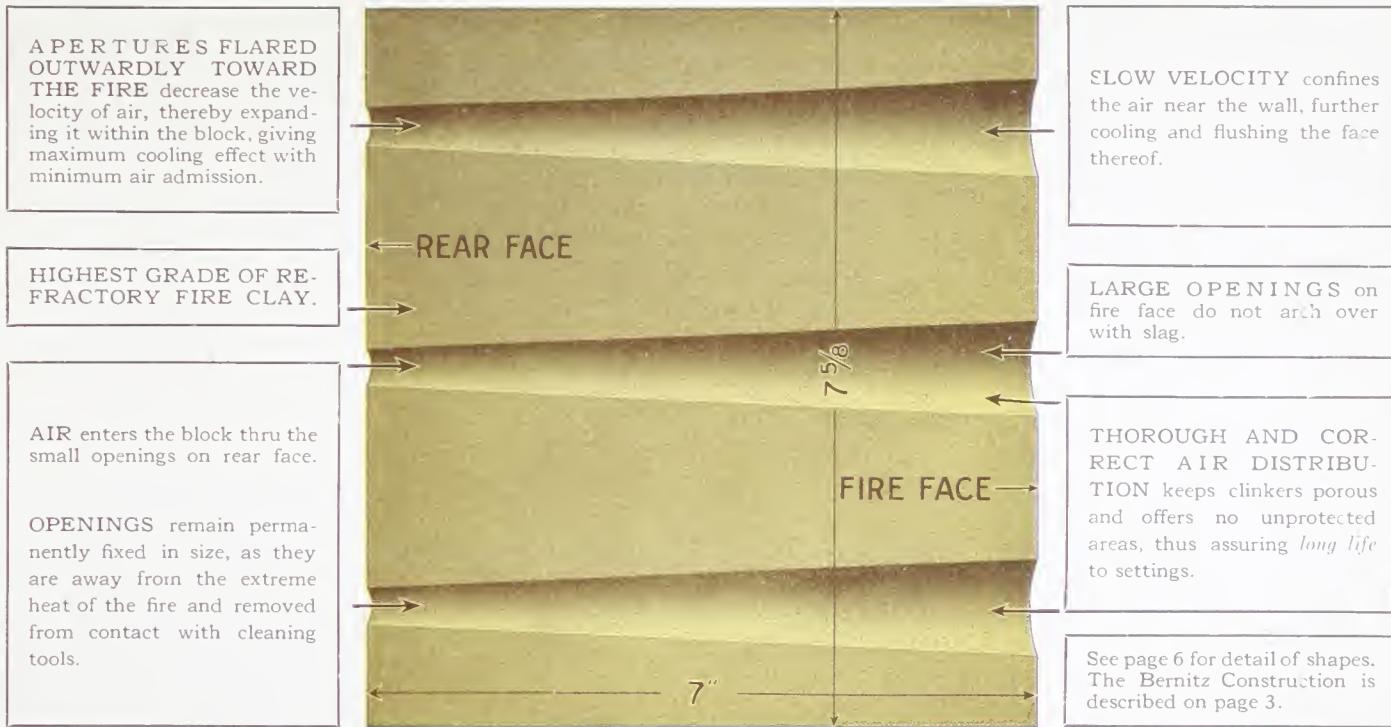
5. No stoker breakage caused by blockading clinkers.

6. Eliminates frequent shutdowns of boilers, because repairs to linings are minimized.

7. Saves labor and makes more contented operators.

The arduous and lengthy task of cleaning walls is eliminated.

8. Freedom from clinker adhesion assures high furnace efficiencies, continuous operation, long life, and low maintenance cost of settings.



## CROSS SECTION THRU BERNITZ CO. CLINKER-PROOF BLOCK

Scale — One-Half Actual Size. Section Typical for Standard Shapes "H" and "E"



Net Weight - - - - - 34 lbs.  
Crated Weight - - - - - 38 lbs.

Material: High Grade Fire Clay;  
One Block replaces 6 standard fire brick.



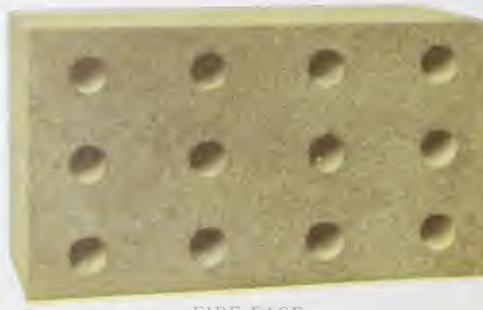
Recommended as our best all-round fire clay shape. It is readily adapted to any layout and fits between the retorts in front wall of Taylor and Riley stokered furnaces. Its weight is easily handled.

## BERNITZ CO. SHAPE "H" CLINKER-PROOF BLOCK

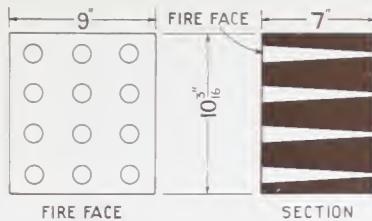


Net Weight - - - - - 52 lbs.  
Crated Weight - - - - - 58 lbs.

Material: High Grade Fire Clay;  
One Block replaces 6 standard fire brick.

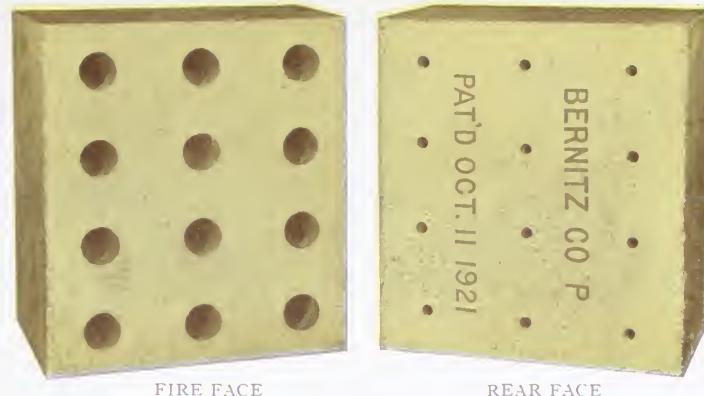


## BERNITZ CO. SHAPE "E" CLINKER-PROOF BLOCK



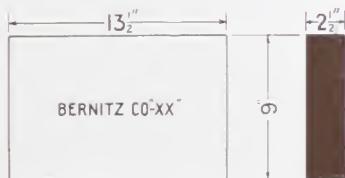
Net Weight..... 45 lbs.  
Crated Weight..... 50 lbs.

Material: High Grade Fire Clay.  
One Block replaces 8 standard fire brick.



This shape is recommended only where blocks of a similar size are to be replaced.

## BERNITZ CO. SHAPE "P" CLINKER-PROOF BLOCK



Net Weight..... 22 lbs.  
Crated Weight..... 25 lbs.



Material: High Grade Fire Clay.  
One Tile replaces 3 standard fire brick.

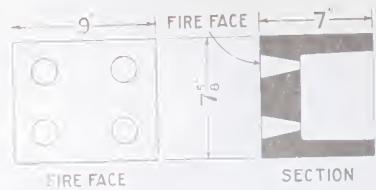
## SHAPE "XX" COVER TILE

Used as a seal to  
the Air Chambers.

**NOTE**  
SPECIAL SHAPES WILL BE MADE UP FOR ANY TYPE OF FURNACE OR CONDITION.

**DAMPERS** — Suitable Dampers are furnished when necessary.

**THIMBLES** — Special Air Intake Thimbles are furnished when the air supply is taken from a cast iron wind box, as in case of the type A Taylor Stokers.

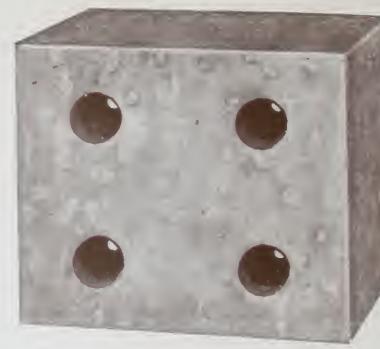


Net Weight ..... 30 lbs.  
Crated Weight ..... 34 lbs.

Material. Carborundum.  
One Block replaces 6 standard fire brick.

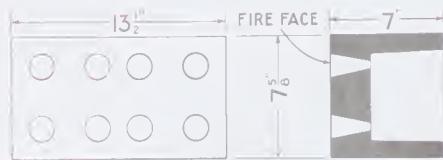


REAR FACE



FIRE FACE

# BERNITZ CO. SHAPE "SH" SUPER BLOCK

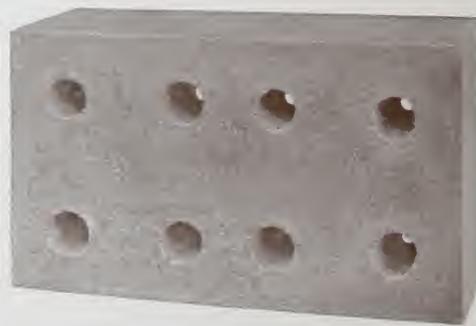


Net Weight ..... 43 lbs.  
Crated Weight ..... 48 lbs.

**Material:** Carborundum.  
One Block replaces 9 standard fire brick.



REAR FACE



FIRE FACE

# BERNITZ CO. SHAPE "SE" SUPER BLOCK

# BERNITZ SUPER BLOCKS — "The Permanent Furnace Lining"

## BERNITZ SUPER BLOCKS

utilize the patented Bernitz ventilating system and function the same as our standard blocks.

The difference is in the refractory of which the blocks are made. Our standard Clinker-Proof Blocks are made of highest grade refractory clays; while our Super Blocks are made of Carborundum, a highly refractory material which has certain physical properties which make it particularly adapted for use with the Bernitz ventilating system, especially wherever severe conditions are encountered and when the best and as nearly permanent lining as possible is desired.

## PROPERTIES OF CARBORUNDUM

which recommend its use with the Bernitz System are

First: Carborundum as used in our Super Blocks has fourteen times greater structural strength than the best fire clays. This structural strength and the fact that it does not readily crumble and chip, allow us to design a block as shown, with recesses or pockets in the rear face and still having more than ample strength. These recesses give very large cooling service for the circulating air, and the effectiveness of this large cooling service is greatly increased because of its close proximity to the heat of the furnace, the ends of the pockets being only  $2\frac{1}{2}$ " from the fire face of the blocks.

Second: Carborundum conducts heat better than any other commercial refractory; nine times better than fire clay. This ordinary weakness is a decided advantage with the Bernitz Construction, because a material with a high thermal conductivity which transmits heat readily can be much more effectively cooled than a good insulating material. With the Bernitz System all heat that is taken out of the linings is delivered back into the furnace as preheated air, thereby aiding combustion. Super Blocks remain intact as originally installed, because the Bernitz System of keeping the material cool protects them from any possible disintegration or oxidation, and prevents slag and molten clinkers from getting any chance to adhere.

Third: Carborundum has one-tenth of the abrasion loss and one-eighth of the spalling loss relative to best fire clay. These desirable qualities are made still greater by keeping the material relatively cool.

## WORKMANSHIP

Bernitz Super Blocks are exceptionally uniform and true to shape. Consequently they require no fitting and are readily laid up with thin joints. We stock a special cement for laying up Bernitz Super Blocks.

## IN SUMMARY

Bernitz Super Blocks — due to the Bernitz Patented System — the design of the blocks — and the physical properties of the material used — give, as the name implies, a Super Furnace Lining that will withstand the most severe furnace conditions. They prevent slag adhesion, resist abrasion of rubbing coal, and avert slag formations which run down the linings.

## USES

Bernitz Super Blocks are successfully used in all types of furnaces, whether equipped with mechanical stokers, hand stokers, shaking grates, forced draft, natural draft, etc. In chain grate installations, where cheap coals are often fired, Bernitz Super Blocks are of particular value. Here one row ( $7\frac{5}{8}$ " high) along each side wall gives ample and much needed protection. We will gladly submit a proposed layout, without any obligation on your part, for any type of furnace and equipment which you may have or are considering.

## LIFE

Bernitz Super Blocks in actual practice under most severe operating conditions are successfully proving their marked superiority over all other types of furnace wall construction. For instance, at one plant where furnaces are equipped with multi-retort stokers and boilers operated at average ratings of 175-250%, and occasional ratings of 400% obtained, Bernitz Super Lining after 33 months' service is absolutely intact and as good as the day it was originally installed. No sign of clinker adhesion, disintegration or bulging of walls whatsoever. Not only has the wall in contact with the fuel bed been completely protected, but the entire setting, as all heavy barring and sledging, which formerly continually weakened the brickwork, have been eliminated.

## STOCK SIZES (See Page Eight)

Special shapes made up for any type of furnace or condition.



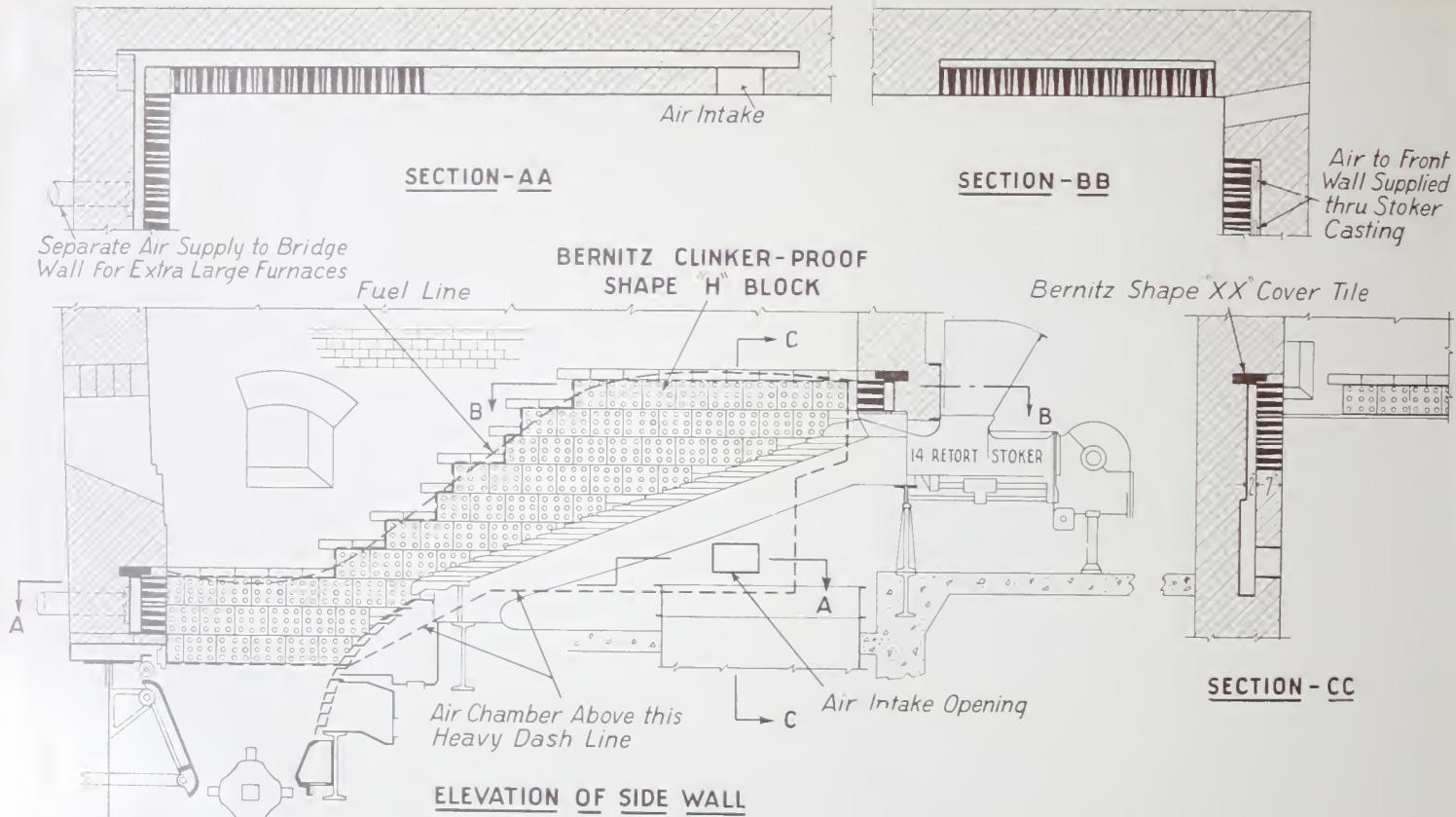
BERNITZ SUPER BLOCKS AFTER TEN MONTHS' SERVICE

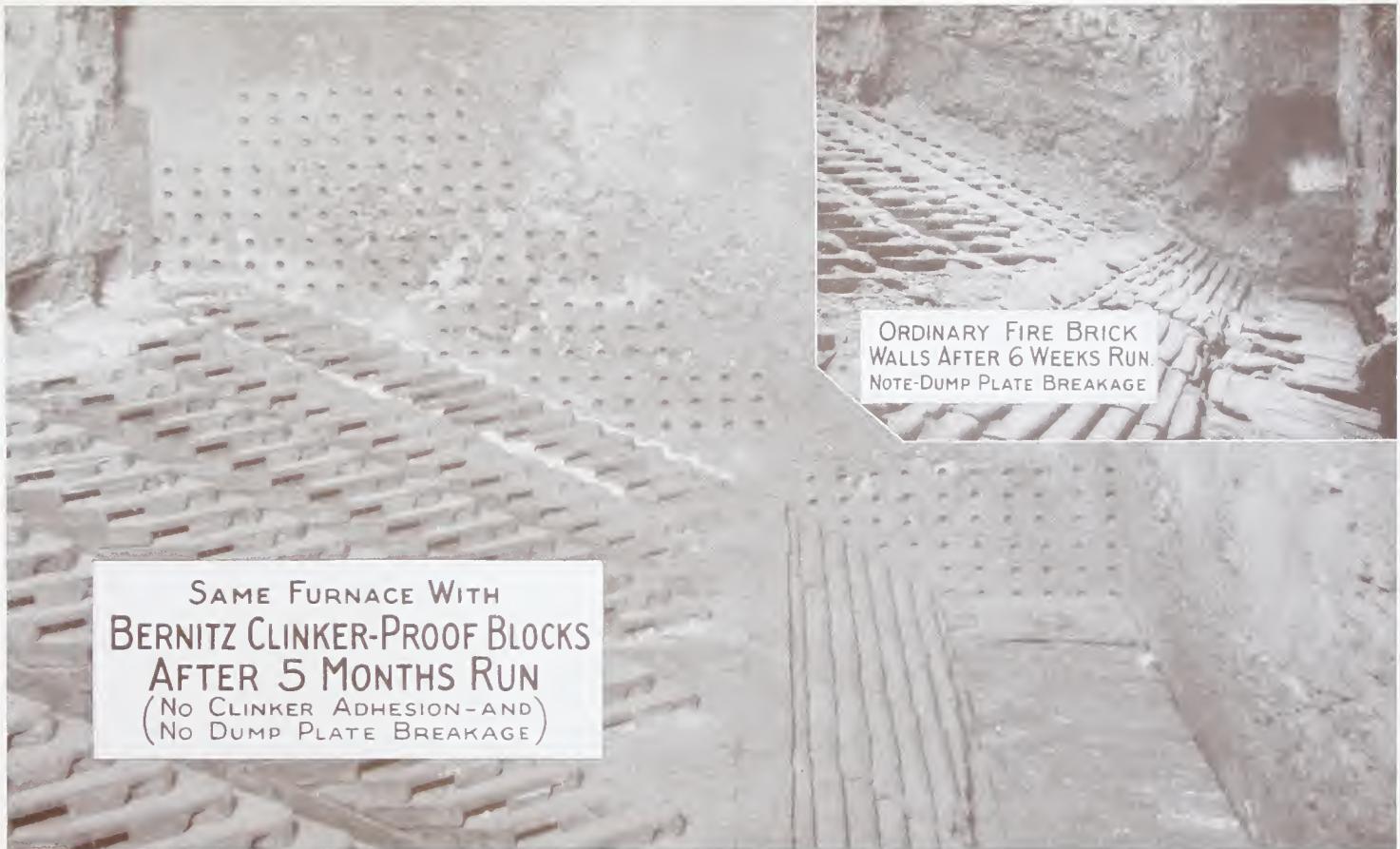
GOOD PROOF OF THE MERITS OF THE BERNITZ CONSTRUCTION IS THAT PRACTICALLY ALL OUR USERS HAVE THE SAME INSTALLED IN ALL OF THEIR BOILER FURNACES.

IN MANY INSTANCES BERNITZ BLOCKS, BY THE HEAVIER AND MORE CONTINUOUS LOADS THEY ENABLE FURNACES TO CARRY, HAVE SAVED THE INSTALLATION OF NEW BOILERS.

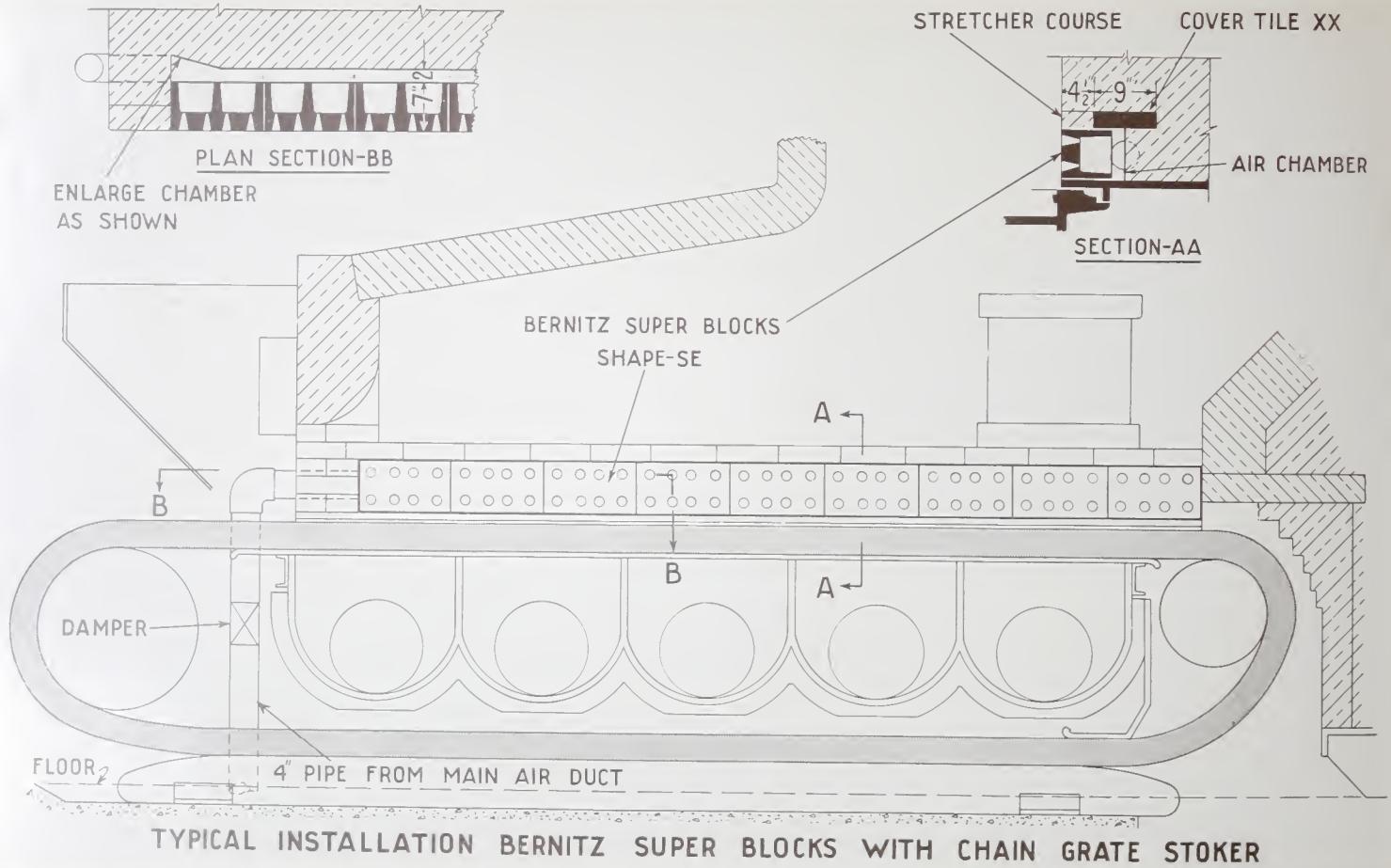


BERNITZ CLINKER-PROOF BLOCKS WITH MULTI-RETORT STOKER AND CLINKER GRINDER





▼  
ORDINARY FIRE BRICK  
WALLS AFTER 6 WEEKS RUN.  
NOTE-DUMP PLATE BREAKAGE



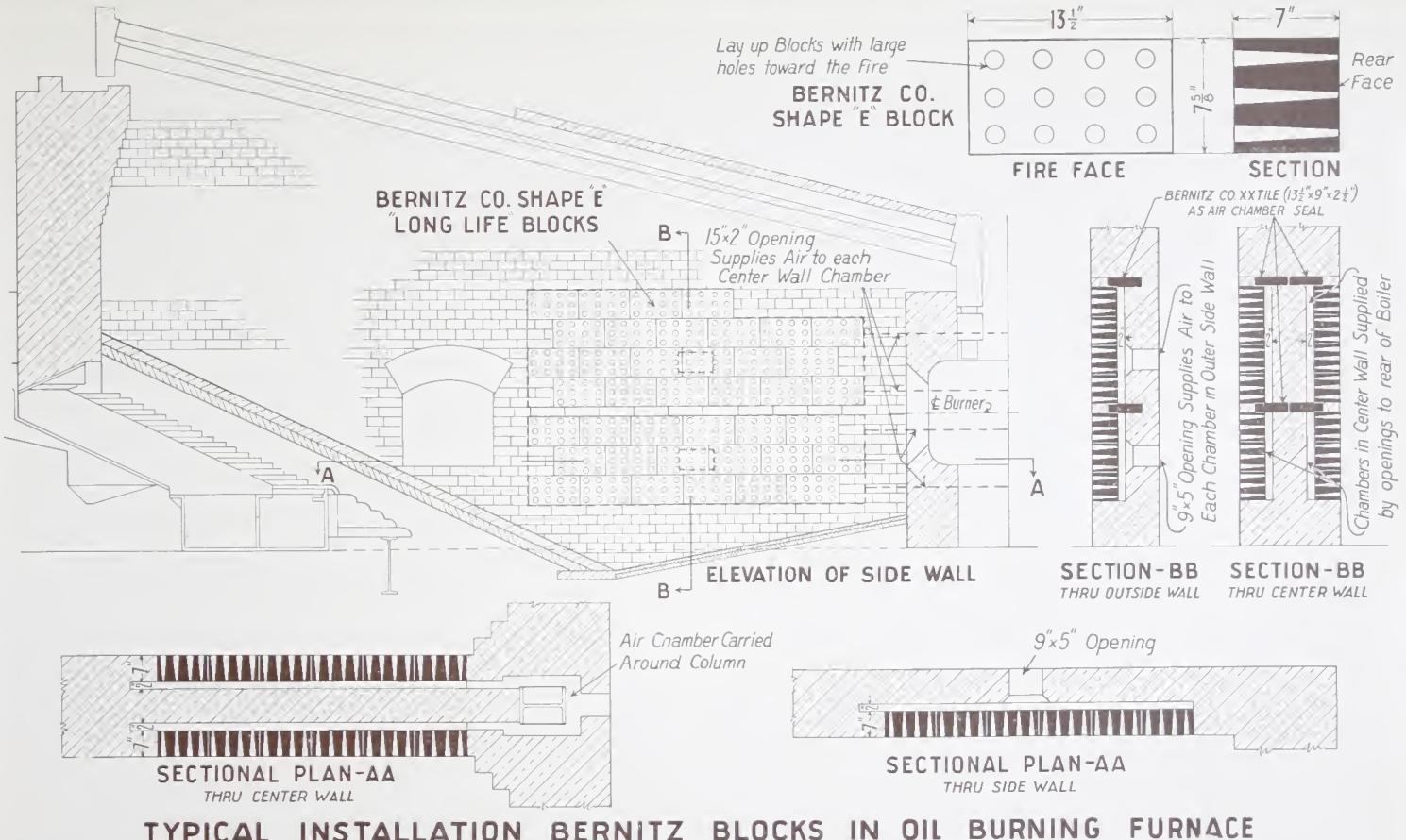


BERNITZ BLOCKS ARE INSTALLED WHERE THEY ARE RECEIVING REAL TESTS; FOR INSTANCE, THIS PLANT OPERATES ITS BOILERS AT RATINGS OF 200-300% FOR 24 HOURS A DAY, 7 DAYS A WEEK.

BERNITZ SUPER BLOCKS WITH MULTI-RETORT STOKER



BERNITZ CLINKER-PROOF BLOCKS WITH SINGLE RETORT STOKER



**TYPICAL INSTALLATION BERNITZ BLOCKS IN OIL BURNING FURNACE**

## REPRESENTATIVE USERS

American Brass Co., Tiverton, Conn.  
American Hardware Corp., New Haven, Conn.  
Arlington Mills, Lawrence, Mass.  
Art Looms Inc., Philadelphia, Pa.

Binghamton Light, Heat & Power Co., Binghamton, N. Y.  
Biel & Son, Inc., R. Weymouth, Mass.  
Boott Mills, Lowell, Mass.  
Boston Elevated Railway Co., Boston, Mass.  
Boston Water Pipe & Fitted Co., Cambridge, Mass.  
Brooklyn Rapid Transit Co., Brooklyn, N. Y.  
Brooklyn Rapid Transit Co., Brooklyn, N. Y.  
Brown & Sharpe Mfg. Co., Providence, R. I.

Cambridge Electric Light Co., Cambridge, Mass.  
Carpentier Sons Co., Camden, N. J.  
Commonwealth Fire & Cold Storage Co., Boston, Mass.  
Converging Company, Hartford, Conn.  
Connecticut Light & Power Co., Berlin, Conn.  
Consolidated Textile Corp., North Adams, Mass.  
Crown Cosmetics, Bridgeport, Conn.

Diamond Alum Co., New Haven, Conn.  
Diamond Match Co., Springfield, Mass.  
Dodge Brothers, Inc., Detroit, Mich.  
E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.  
Edison Keppler Co., New Haven, Conn.  
Eriez Light Co., Blawnox Island, Conshohocken, Pa.  
Eriez Light Co., Cotton Station, Springdale, Pa.  
Eriez Corporation, Erie, Pa.  
Eliason Electric Manufacturing Co., Detroit, Mich.  
Elliott Electric Manufacturing Co., Worcester, Mass.  
El Paso Water, Light & Power Co., El Paso, Tex.  
Emerson Gossamer Corp., North Attleboro, Mass.  
Fawcett Mills, Lawrence, Mass.

Fisk Rubber Co., Chicopee Falls, Mass.  
Fitchburg Gas & Electric Light Co., Fitchburg, Mass.  
Ford Motor Co., Detroit, Mich.  
H. H. Franklin Mfg. Co., Syracuse, N. Y.

Robert Gair Co., Haverhill, Mass.  
Robert Gair Co., Montville, Conn.  
General Electric Co., Pittsfield, Mass.  
Great Northern Paper Co., Millinocket, Me.  
Great Northern Paper Co., E. Millinocket, Me.

Hartford Electric Light Co., Hartford, Conn.  
Haverhill Electric Co., Haverhill, Mass.  
Hoof Rubber Co., Watertown, Mass.  
Harman Ross Fibre Corp., Hopewell, Va.

Interborough Rapid Transit Co., New York, N. Y.

Kirkton & Son, Brooklyn, N. Y.

A. C. Lawrence Leather Co., Peabody, Mass.  
Lever Brothers Co., Cambridge, Mass.  
Little Rock Railway & Electric Co., Little Rock, Ark.  
Lowell Electric Light Corp., Lowell, Mass.  
Lynn Gas & Electric Co., Lynn, Mass.

Mansfield Traction Light & Power Co., Manchester, N. H.  
Massachusetts Institute of Technology, Cambridge, Mass.  
Massachusetts School for Feeble-minded, Waverley, Mass.  
W. H. McKesson & Sons Mfg. Co., Manchester, N. H.  
Meredith Electric Light Co., Meriden, Conn.  
Merrimack Mfg. Co., Haverhill, Mass.  
Metropolitan Edison Co., Reading, Pa.  
Milwaukee Carpet Co., Amsterdam, N. Y.  
Monongahela West Penn Public Service Co., Fairmont, West Va.  
Mount Holyoke, Massachusetts, Mass.  
Moore Salt Co., Lansing, Mich.

## REPRESENTATIVE USERS — (Cont.)

Nashua Manufacturing Co., Nashua, N. H.  
Narragansett Electric Lighting Co., Providence, R. I.  
National Aniline & Chemical Co., Buffalo, N. Y.  
National Sugar Refining Co., Yonkers, N. Y.  
New England Power Co., Uxbridge, Mass.  
New York & Pennsylvania Co., Lock Haven, Pa.  
North Adams Gas Light Co., North Adams, Mass.  
North American Chemical Fibre Co., Bay City, Mich.  
Norwich State Hospital, Norwich, Conn.  
  
Oakville Company, Oakville, Conn.  
Ohio Public Service Co., Melco, Ohio  
Oliver Estate, Pittsburgh, Pa.  
  
Pacific Mills, Lyman, South Carolina  
Paducah Electric Co., Paducah, Ky.  
Penobscot Chemical Fibre Co., Great Works, Me.  
Penn Central Power Co., Saxon, Pa.  
Penn Public Service Corp., Seward, Pa.  
Pennsylvania Edison Co., Easton, Pa.  
Pennsylvania Sugar Co., Philadelphia, Pa.  
Philadelphia Electric Co., Chester, Pa.  
Philadelphia Electric Co.,  
    Delaware Station, Philadelphia, Pa.  
    Christian St. Station, Philadelphia, Pa.  
Philadelphia Suburban Gas & Electric Co., Phoenixville, Pa.  
Phoenix Utility Co., Cape Fear, N. C.  
Pittsfield Electric Co., Pittsfield, Mass.  
Portland Railway Light & Power Co., Portland, Ore.  
Potomac Electric Power Co., Washington, D. C.  
Public Service Electric Co., Camden, N. J.  
Public Service Electric Co., Burlington, N. J.  
Public Service Electric Co., Newark, N. J.  
  
Republic Iron and Steel Co., Youngstown, Ohio  
Revere Sugar Refinery, Charlestown, Mass.  
Rockingham County Light & Power Co., Portsmouth, N. H.  
Rockland Light & Power Co., Hillburn, N. Y.

Salem Electric Lighting Co., Salem, Mass.  
Sandusky Gas & Electric Co., Sandusky, Ohio  
A. Schrader's Son, Inc., Brooklyn, N. Y.  
Seamless Rubber Co., New Haven, Conn.  
Solvay Process Co., Syracuse, N. Y.  
Standard Tin Plate Co., Canonsburg, Pa.  
Standard Sanitary Mfg. Co., Pittsburgh, Pa.  
State, War, and Navy Bldg., Washington, D. C.  
Staten Island Edison Corp., Staten Island, New York  
Stearns Lighting & Power Co., Ludington, Mich.  
St. Croix Paper Co., Woodland, Me.  
Susquehanna Collieries Co., Lykens, Pa.  
  
Tennessee Eastern Electric Co., Watauga, Tenn.  
Tremont & Suffolk Mills, Lowell, Mass.  
Turners Falls Power & Electric Co., Chicopee, Mass.  
  
United Electric Light Co., Springfield, Mass.  
United Illuminating Co., Bridgeport, Conn.  
United Illuminating Co., New Haven, Conn.  
United Shoe Machinery Corp., Beverly, Mass.  
United States Aluminum Co., Alcoa, Tenn.  
U. S. Finishing Co., Sterling Branch, Sterling, Conn.  
U. S. Finishing Co., Queen Dyeing Co., Providence, R. I.  
U. S. Finishing Co., Silver Spring Branch, Providence, R. I.  
United States Naval Academy, Annapolis, Md.  
United States Navy Yard, Boston, Mass.  
United States Navy Yard, Philadelphia, Pa.  
United States Navy Yard, Portsmouth, N. H.  
U. S. S. Lead Refinery, E. Chicago, Ind.  
Victoria Mills, Thornton, R. I.  
Wanskuck Mills, Providence, R. I.  
Whitin Machine Works, Whitinsville, Mass.  
Wilmington & Philadelphia Traction Co., Wilmington, Del.  
Worcester Electric Light Co., Worcester, Mass.  
Yale University, New Haven, Conn.  
Youngstown Sheet & Tube Co., Struthers, Ohio

## INSTRUCTIONS FOR INSTALLING BERNITZ BLOCKS

The following instructions will enable any competent boiler setting mason or repairman to install Bernitz Blocks properly. These Blocks are as readily laid up as ordinary fire brick. There is nothing complicated about the installation, but these instructions will simplify the work and insure best service and results.

1. Familiarize yourself with the drawings we furnish. Follow them where possible as the layouts shown have been developed by us only after considerable experience and tests.

2. Lay up the blocks in nothing but a good grade of high temperature cement which air sets. Sufficient temperature is not obtained with the Bernitz construction to flux fire clay and cements which require heat to bond cement to brickwork.

On repair jobs four pounds of high temperature cement per Shape H (six pounds per Shape E) are sufficient to lay up blocks and to take care of necessary patching.

On new work, figure three pounds per Shape H (four and one-half per Shape E). List of cements which we have found satisfactory will be furnished upon request. Mix cement with enough water to have the consistency of mortar. Lay thin joints and squeeze blocks in place.

3. The place to start installing the blocks is at the junction of the bridge and side walls.

4. Seal off bridge wall expansion joint as shown on drawing.

5. Be careful to have all chambers and intakes of sizes shown and chambers securely sealed so as to prevent air leaks.

6. Do not leave any dirt or mortar in air chambers. Clean them out thoroughly before laying cover tile.

7. Be sure that the perforations in blocks are all clear and open. After completion of installation insert a  $\frac{3}{8}$ " rod thru each aperture so as to be positive that all are clear.

## CARE OF BERNITZ CONSTRUCTION AFTER INSTALLATION

Whenever your fires are down carry out the following instructions. They are simple and will greatly increase the life of your entire settings.

1. Periodically clean out all siftings and dirt which may have collected in your stoker wind box or Bernitz air intakes. This should be done at least every two months, preferably every month.

2. In some cases a slight skin slag may collect on the surface of the blocks. Do not remove this. If perchance it has arched over any of the openings, simply clean out the opening with a drill point.

3. Insert a rod in each hole to see that all are clear.

4. A differential gauge connected to the Bernitz air chambers, when furnaces are in operation, is useful to check up pressures in the chamber.

## BERNITZ SERVICE

Our engineering department will gladly prepare proposed layouts for any type of furnace and conditions.

Complete construction layouts of Bernitz Blocks are furnished for all installations.

Whenever desired we furnish the services of a competent engineer to supervise or inspect the installation of Bernitz Blocks, charging only for traveling and living expenses incurred in connection with the work.

Avail yourself of our service.

## TEAR OUT AND SEND

Bernitz Furnace Appliance Co.  
177 State Street  
Boston, Mass.

Gentlemen:

Without any obligations on our part we should like to receive a proposed layout of Bernitz Clinker-Proof Blocks for our furnaces.

Number of furnaces..... Inside width of furnace..... Inside depth of furnace.....

Thickness of front wall..... Thickness of side wall..... If battery setting, thickness of center wall.....

If stoker equipped: Make..... Type..... Retorts.....

If oil burning: Number of burners per furnace..... Type..... Location of burners.....

Approximate average ratings..... Peak ratings.....

\*We are enclosing blue prints: No..... showing layout of furnaces in which we are interested.

(Give any additional information regarding special conditions)

Very truly yours,

\*Print is not imperative. However, it will greatly assist in making proposed layout.

By..... Position.....

